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EXAMINER	
SOUW, BERNARD E	
ART UNIT	**PAPER NUMBER**
2881	

DATE MAILED: 01/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H·A

Office Action Summary	Application No.	Applicant(s)	
	10/777,672	RAY ET AL.	
	Examiner	**Art Unit**	
	Bernard E Souw	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 20 December 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-29 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-29 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 11 February 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 05/18/2004.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Applicant's Amendment

1. The Amendment filed 12/20/2004 has been entered. The present Office Action is made with all the arguments being fully considered.

The specification has been amended.

Claims 14 and 17 have been amended.

Claims 1-29 remain pending in this office action.

§ 112 Rejection Withdrawn

2. Claim 14 having been properly amended, its previous rejection under 35 U.S.C. 112, second paragraph, is now withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 14-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. (USPAT 6,576,908) in view of general knowledge in the art.

► Regarding claims 14 and 20, Lundquist et al. disclose a method of using a charged particle beam (CPB), comprising a charged particle beam 520 shown in Fig.5 milling through one or more layers of material 300, as recited in sect.[0053]/lines 3-6, to expose a circuit element 310, 330, or 340 shown in Fig.3A,B,C,D, as recited in the Title and in the Abstract lines 1-14; detecting an output signal caused by the impact of the focused ion beam, the output signal including a secondary charged particle signal or a stage current, as recited by Lundquist et al. in sect.[[0015]: "*There are a number of techniques for FIB operation endpoint detection in use including monitoring sample stage current, monitoring a secondary electron detector signal, monitoring a secondary ion detector signal, monitoring a secondary ion mass spectrometer signal and even monitoring a photo-emission signal from excited secondary particles.*"

Further, the first limitation of Applicant's claim 14 recites, "*charged particle beam milling through one or more layers of material to expose the circuit element*". This "circuit element" is understood in the art as being made of various materials having clear materials interface, i.e., to be distinguished from Lundquist's "diffusion region" which has diffuse "*interface*". Although Lundquist's particular invention primarily uses a power supply current to detect the endpoint in a milling process involving diffusion regions, Lundquist et al. do suggest --for specific cases such as Applicant's-- to use a secondary charged particle signal or a sample stage current for detecting clear materials interfaces, as indicated by Lundquist in the same sect.[0015] cited above, which continues in lines 7-12: "*These techniques* [i.e., using secondary charged particle signal or a sample stage current] *all rely on a signal change at a material*

boundary or interface and are difficult to apply to backside operations where milling often must be reliably stopped before diffusion regions are perturbed where there is no meaningful materials interface but merely a change in doping impurity concentration."

One of ordinary skilled in the art understands in Lundquist's sect.[0015] above that Lundquist's method of using secondary charged particle signal or sample stage current is just appropriate for detecting clear materials interfaces; they work even better! Thus, Lundquist's teaching is not to be interpreted as teaching away from using secondary electron detector signal or sample stage current, but in the contrary, must be interpreted as favoring the use secondary charged particle signal or a sample stage current, as further recited by Lundquist's in sect.[0068], "*Finally in step 440, other operations including higher aspect ratio operations are completed to expose and gain access to circuit elements such as interconnect in the IC. These operations usually use conventional secondary electron-based end-point detection because of the clear material interface between the metal interconnect and the insulating interlayer dielectric.*"

Thus, regarding present claim 14, Lundquist et al. factually make use of secondary electron signal as a conventional method for detecting interconnects, as recited in sect.[0062]/lines 13-19 and claim 14; Lindquist et al. then proceed with providing the output signal to a circuit adjusted to improve the signal-to-noise ratio of a signal at a blanking frequency, which is equivalent to the same step used for endpoint detection of diffusion regions, as recited in sect.[0053]/lines8-12, sect.[0054]/lines 1-12 and sect.[0055]; and ceasing to mill when the output of the circuit adjusted to improve

the signal-to-noise ratio of a signal at the blanking frequency changes more than a predetermined amount, the change indicating a change of material impacted by the charged particle beam, which is the same step equivalent to the Lundquist's case involving diffusion region recited in sect.[0058]/lines 1-7 and sect.[0060]/lines 1-6, here consequently modified by Lundquist's sect.[0015], [0062], [0068] and claim 14, as recited previously.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the same steps as in using power supply monitoring for endpoint detection involving diffusion regions, now also in the instant case of using secondary electron monitoring to detect circuit elements having clear materials interface, since not only is the secondary electron method just appropriate for detecting clear materials interfaces, as taught by Lundquist et al. in sect.[0015], [0062], [0068], and claim 14, but also easier to implement, for being one of the conventional methods well known in the art.

How to convert Lundquist's power supply monitoring arrangement into equivalent secondary electron monitoring or stage current monitoring set-up, is well known in the art, as made clear by the wording "conventional" used by Lundquist, and further supported by ample of references in case Applicant would challenge this "conventional" and well-known conversion as an Official Notice. Apart from the well-known difference in measuring arrangement or provision, the equivalent steps are basically the same. The further rejections recited below are therefore made based on the corresponding steps implemented by Lundquist et al. in using power supply monitoring for detecting

diffusion regions, here tacitly modified by replacing the power supply monitoring provisions or steps with their equivalent but more conventional secondary electron monitoring and/or stage current monitoring provisions or steps:

► Specifically regarding claim 20, the additional limitation of periodically pulsing or blanking the beam 520, as recited in sect.[0058]/lines 1-3.

Specifically regarding claim 20, the limitation of applying modulating signal to a conductor in the circuit is the equivalent of Lundquist's periodical pulsing or blanking the beam 520 recited in sect.[0058]/lines 1-3, here consequently modified by replacing the power supply monitoring provisions or steps with their equivalent but more conventional secondary electron monitoring provisions or steps, as indicated by Lundquist et al. in sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14. Since this method is conventional, Lundquist et al. do not provide detailed steps, as they are presumed to be well known in the art. However, to satisfy curiosity or inquiry from those less skilled in the art, more specific details inherent to this conventional method of monitoring secondary emission will be given in the Examiner's Response to Applicant's Arguments.

► Regarding claims 15 and 16, the limitation(s) of ceasing to mill when the element is uncovered "before" it is severed (claim 15) and/or it is "already severed" (claim 16), is are/is inherently recited in sect.[0062] on pg.4/col.2/lines 1-12 from bottom, continued on pg.5/col.1/lines 1-5. A modification by replacing the power supply current monitoring with Lundquist's secondary emission current <u>is not necessary</u>, because in detecting

interconnect 340 in Fig.3D, a secondary emission monitoring method is already being used, as recited in the same section, pg.4/col.2/lines 6-12 from bottom.

► Regarding claims 17, 21, 22 and 23, the use of a lock-in amplifier, a band-pass filter, or --in general-- a circuit sensitive to the frequency component of the detected signal, is recited in sect.[0053]/lines 10-12 and sect.[0054]/lines 5-12, here modified according to Lundquist's sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14, as recited above.

► Regarding claims 18 and 27, the limitation of signal from a current of secondary electrons ejected from the work piece is recited in sect.[0015]/lines 1-7, sect.[0027]/lines 1-4, sect.[0062]/lines 13-19, sect;[0069]/lines 1-5, and in claim 14, lines 4-5, here modified according to Lundquist's sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14, as recited previously.

► The frequency range limitations of claims 19, 25 and 26 are recited in sect.[0054]/lines 1-5, modified according to Lundquist's sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14, as recited previously.

► Regarding claim 28, the limitation of a focused ion or electron beam is inherent in the FIB (focused ion beam) technique used by Lundquist et al., as recited in sect.[0006]/lines 8-10, sect.[0008]/lines 1-3, sect.[0015]/lines 1-7, and specifically implicated in sect.[0051]/lines 14-16, here modified according to Lundquist's sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14, as recited previously.

4. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. in view of general knowledge in the art.

Lundquist et al. show all the limitations of claim 24, as previously applied to the parent claim 20, except the recitation of applying a modulating signal having a frequency greater the inverse of the breakthrough period and less than one half of the ion frequency.

It is generally known in the art, that, in order to process and manipulate a work piece involving a breakthrough, the breakthrough process has to be monitored under a time resolution better (i.e., smaller) than the breakthrough process itself, i.e., a time resolution less than the breakthrough period, defined as the time interval needed by the ion beam to complete a breakthrough, T_B. Therefore, the modulating signal (at a modulation interval $T_M=1/f_M$, where f_M is the modulation frequency) used for monitoring a breakthrough process, must be faster, i.e., the interval T_M shorter, than the (time interval of) breakthrough process, i.e., $T_M < T_B$, or, in other words, its frequency must be greater than the inverse of the breakthrough period, or $f_M = 1/T_M > 1/T_B$, precisely as recited in the claim.

The second part of the claim limitation applies especially if the ion beam itself has a repetitive frequency $f_{ion}=1/T_{ion}$ different than the previously recited modulation frequency f_M, since it is also *generally known in the art* that the modulation frequency $f_M=1/T_M$ should not exceed the ion beam repetition frequency f_{ion}, whereby the number one-half is not critical. It is quite easy for one of ordinary skill in the art to figure out, that, in order to observe a breakthrough using a minimum time interval of only two

successive observation, i.e., within one (more than one would steer even further away from Applicant's claim) time interval of T_M, the ion beam has to strike least once inbetween, or, $T_M > n \cdot T_{ion}$ with $n \geq 1$ (see Examiner's Response to Applicant's Argument, Fig.1, for n=1, and Fig.2 for n>1), or, in other words, the modulation frequency $f_M = 1/T_M$ must be less than f_{ion}/n, with $n \geq 1$. Of course, n=2 (Fig.3) is also enabling (for a breakthrough recognition), rendering obvious Applicant's 2nd part of the claim, that the modulation frequency $f_M = 1/T_M$ be less than one half the ion beam frequency $f_M = 1/T_M \leq f_{ion}/2$. However, this condition is not critical, since n=2,3,4 ... (or any fractional number >1) are also enabling --insofar as T_M is less than T_B--, as obvious in Fig.2 and Fig.3). Neither is n=2 optimal, since n=1 would have been sufficient to allow a detection of breakthrough. Therefore, the Examiner herewith confirms, Applicant's n=2 would also do the job, but not critical, as already recited in the previous Office Action.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a modulating signal frequency that is greater than the inverse of the breakthrough period and less than one half the ion beam frequency, in order to process and manipulate a work piece that involves a breakthrough, since this is a general knowledge in the art that does not need any auxiliary teaching.

Note: The present version of the claim 24 rejection is essentially the same as the previous one, except for the underlined phrases, which are here added to elucidate the term "uncritical" used in the previous Office Action and challenged by Applicant.

5. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. in view of general knowledge in the art.

Lundquist et al. show all the limitations of claim 29, as previously applied to the parent claim 20, except the recitation of periodically sampling the secondary charged particle beam current.

Ludquist et al. recite in sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14 the limitations of (a) *sampling* the stage current generated by the CPB and (b) monitoring the *secondary electron signal*, as two viable techniques for FIB endpoint detection.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to [mix] choose from the two alternative techniques [into] the particular method of "*sampling the secondary electron signal*", as recited in applicant's claim 29, since [mixing] using the secondary emission technique is already inherent in Lundquist's teaching, specifically as recited in sect.[0068] and claim 4, and is generally available to one of ordinary skill in the art without a need of any auxiliary teaching.

Note: Changes with respect to previous Office Action are underlined, showing only a reformulation, but no new ground of rejections.

6. Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lundquist et al. in view of Talbot et al. (USPAT 5,140,164) or Rasmussen (USPAT 5,435,850).

Lundquist et al., either alone or in view of general knowledge in the art specifically regarding the use of secondary emission monitoring method according to Lundquist's sect.[0015], [0062], [0068] and claim 14, as recited previously, show all the limitations of claims 1-13 as previously applied to claims 14-29, except the recitation that the CPB is *patterned*, as recited in the independent claim 1.

Talbot et al. disclose a modification of integrated circuit using a focused ion beam (FIB) system, as recited in the Title and the Abstract, for determining milling end-point, as recited in the Abstract/lines 6-10. Talbot's FIB is applied in a pattern, as recited in Col.5/ll.7-24.

Rasmussen also discloses a FIB for removing circuit structures in semiconductor devices, as recited in Col.1/ll.8-18. Rasmussen's FIB is applied in a definite raster pattern, as recited in Col.1/ll.19-21.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a modulating pattern to the milling ion beam of Lundquists's as taught by Talbot et al. and/or Rasmussen, in order to process a large area of a semiconductor circuit in one step, instead of processing only a small area of the size of the ion beam focus, as in case of Lundquist's.

► Claim 2 recites the same limitation as claim 17 or claim 22, except for its dependence on claim 1. Claim 2 is therefore rendered obvious by the same token as previously applied to claims 17 or 22, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

► The limitations of claims 3 and 4 are inherent to the use of lock-in amplifier, as generally known in the art. Claims 3 and 4 are therefore rendered obvious by the same token over the same prior art references as previously applied to claim 2.

► The limitations of claims 5 and 6 are rendered obvious by Lundquist et al. in sect.[0062] on pg.4/col.2/lines 1-12 from bottom, continued on pg.5/col.1/lines 1-5. A modification by replacing the power supply current monitoring with Lundquist's secondary emission current <u>is not necessary</u>, because in detecting interconnect 340 in Fig.3D, a secondary emission monitoring method is already being used, as recited in the same section, pg.4/col.2/lines 6-12 from bottom.

► Claim 7 recites the same limitation as claim 19. Claim 7 is therefore obvious over the same ground as previously applied to claim 19, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

► Claim 8 recites the same limitation as part of claim 14. Claim 8 is therefore obvious over the same ground as previously applied to claim 14, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

► Claims 9, 10, 12 and 13 recite the same limitation as that of claims 18, 27 and 29. Therefore, claims 9, 10, 12 and 13 are obvious over the same ground as previously applied to claims 18, 27 and 29, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

Specifically regarding claim 13, the limitation of an output signal not provided by way of an electrical conductor attached to the work piece is here represented by the signal of secondary electrons released by the ion beam out of the work piece.

► Claim 11 recites the same limitation as claim 28. Claim 11 is therefore obvious over the same ground as previously applied to claim 28, however, with an additional prior art (Talbot et al. or Rasmussen) under U.S.C. 103 to take account for the dependency on claim 1.

Response to Applicant's Arguments

7. Applicant has misunderstood Lundquist's invention and teaching. As already stated previously, Lundquist et al. do suggest using a secondary charged particle signal or a sample stage current to detect clear materials interfaces, as unambiguously recited by Lundquist in sect.[0015]/lines 1-12 and sect.[0068] cited previously. To unambiguously refute Applicant's obvious misunderstanding, Lundquist's sect.[0062]/lines 13-19 recites: "*As the interconnect 340 is being exposed during this operation, conventional endpoint detection techniques such as monitoring the secondary electron signal* ***work well*** *as there is a materials interface (not shown) between the dielectric 345 and interconnect 340 that results in a change in the secondary electron signal that can be readily monitored.*" Lundquist's invention even makes a claim on using this secondary electron signal, i.e., in **claim 14**.

Thus, refuting Applicant's argument, not only Lundquist et al. suggest the use of secondary charged particle signal, but even further, Lundquist's invention does anticipate Applicant's claim 14, the latter reciting in its second limitation, "*detecting an*

output signal caused by the impact of the focused ion beam, the output signal including a <u>secondary charged particle</u> signal or a stage current", wherein Lundquist's secondary electron signal, as recited above, undeniably also represents Applicant's "*secondary charged particle signal*". Similarly, claim 20 also recites secondary emission, but no stage current monitoring technique. Since the use of <u>at least</u> secondary emission is <u>inherent</u> in Lundquist's, <u>the previous §102 rejection of claim 14 is proper</u> (and hence, the dependent claims 15-29). However, the Examiner is ready to convert all the §102 rejections into §103 rejections, with Lundquist et al. as a single reference, without changing or revising the ground for rejection(s). This allows this Office Action to be made Final.

Note, because of the inherency of using secondary emission in Lundquist's, no auxiliary reference is necessary. However, as a courtesy from the Examiner, references are here given as support to Lundquist's statement that secondary electron signal and stage current monitoring are <u>conventional</u> endpoint detection techniques. These references are, e.g., (1) Birdsley et al. (USPAT 6,210,981), reciting secondary emission monitoring in Col.7/ll.23-27 and stage current monitoring in Col.8/ll.4-8; (2) Takahashi et al. (USPAT 6,753,253), reciting secondary emission monitoring in the Abstract, in Col.2/ll.55-65, and throughout the disclosure; (3) Keckley et al. (USPAT 6,031,229), reciting stage current monitoring in Col.2/ll.37-54 in reference to Fig.5, and in Col.3/ll.61-64; and (4) Winer et al. (USPAT 5,948,217), reciting in the Abstract/lines 10-21 and in Col.5/ll.18-48 stage current monitoring in a milling process for endpoint detection involving diffusion region. By the way, Winer et al. cited above also refutes

Applicant's further incorrect interpretation of Lundquist's teaching: as opposed to Applicant's interpretation, secondary electron signal and stage current monitoring could as well be used for detecting diffusion region such as in Lundquist's invention.

8. Specifically regarding claim 20, the inherency of the steps of "applying a modulating signal to the conductor within the work piece" and "generating a detector signal from the (secondary emission) current" is evidenced by Birdsley et al., as recited in Col.6/ll.29-43 in reference to Fig.3. Modulating the circuit under process is thus a conventional equivalent to modulating the ion beam through its power supply, while it is also generally known in the art that both types of modulation may be applied simultaneously.

9. Regarding claim 24, Applicant's argument against the Examiner's statement, "it is also generally known in the art that the modulation frequency should not exceed the ion beam repetition frequency, whereby the number one-half is not critical" is unpersuasive, since it is based on a wrong premise. As demonstrated above by the Examiner's present version of the rejection, in which exactly the same wording was used as in the previous Office Action, but now supported by formulas to show its logical and mathematical correctness, the number one-half is indeed non-critical, since a necessary and sufficient condition for an unambiguous recognition of a breakthrough is $T_M > n \cdot T_{ion}$ **with n=1**, as is also self-obvious in Fig.1 through Fig.4 below. Of course, n=2 is also enabling, as recited previously, but also any n=3, 4,... or any fractional number of n, as

long as n>1, which can be easily seen in Fig.3 and Fig.4 below. Applicant's argument "to allow at least <u>two samples</u> of beam induced secondary emission signal to be captured <u>per modulation</u> period" does not make sense, since such is obviously unnecessary for recognizing a breakthrough. Instead of Applicant's <u>two</u> samples (marked by "ion" in Fig.1-4) per modulation period (between two "mod" markings in Fig.1-4), <u>one</u> sample per modulation period is sufficient to distinguish a sample of beam-induced secondary emission from the next sample (or, from the previous one) from the change of secondary emission measured during one modulation period, as is obvious from Fig.1 through Fig.4 below.

Fig.1: $T_M > n \cdot T_{ion}$ with n=1

```
 ion     ion     ion     ion     ion
 ↓...Tion...↓.........↓.........↓.........↓
-----------------------------------------------→ t
  .↑...TM...↑.........↑.........↑
  mod     mod     mod     mod
```

Fig.2: $T_M > n \cdot T_{ion}$ with n>1

```
 ion     ion     ion     ion     ion
 ↓...Tion...↓.........↓.........↓.........↓
-----------------------------------------------→ t
  ↑... TM ....↑............↑............↑
  mod      mod       mod      mod
```

$T_B > T_M$

```
----------------------------------------
▲ breakthrough period ▲
```

Fig.3: $T_M > n \cdot T_{ion}$ with n=2

```
ion     ion     ion     ion     ion
↓.........↓.........↓.........↓.........↓..
-----------------------------------------------→ t
...↑...................↑..:..................↑..
 mod               mod               mod
```

Fig.4: $T_M > n \cdot T_{ion}$ with n=3

```
 ion ion ion ion ion ion ion
 ↓....↓....↓....↓....↓....↓....↓...↓
------------------------------------------→ t
 ↑..............↑...............↑.
 mod         mod          mod
```

Two samples per modulation, as claimed by Applicant, does not bring anything new, nor does it optimize the sampling method, as claimed by Applicant. In the contrary, the time resolution is getting worse with increasing value of n. Smaller n<1 means better time resolution, but inefficient modulation.

It is also true that this simple conclusion does not need auxiliary teaching, as previously stated. In the event Applicant would deny this simple fact, i.e., how easy it is for one of ordinary skill in the art to come to this conclusion, the denial must be based on an inappropriately estimated level of "*ordinary skill in the art*". According to the standard level in the art, such a conclusion can be mathematically derived by <u>any person of ordinary knowledge in the art in (much) less than 1 minute</u> (logical conclusion even instantly). Therefore, Applicant's citation of MPEP 2144.03(A) that "assertions of technical facts in the areas of esoteric technology or specific knowledge of the prior art must always be supported by citation to some reference work recognized as standard in the pertinent art", does not apply in this case, since the Examiner's assertion is a plain and simple logic generally shared by those ordinary skilled in the art. Rather, it is Applicant's number ½ that is to be deemed "esoteric".

10. Regarding claim 29, in contradiction to Applicant's allegation, Lundquist et al. <u>do teach both</u> the methods of monitoring secondary emission as well as monitoring the stage current, as recited in sect.[0015]/lines 2-3, sect.[0062]/lines 13-19, sect.[0068] and claim 14. Furthermore, claim 29 does not depend on claim 15, as recited on pg.13 of Applicant's response, but on claim 20, the latter reciting the limitation of "*generating a*

detector signal from a current generated by the particle beam", which is here understood as being a secondary particle current recited by Lundquist in sect.[0015], [0062] and [0068]. Even if the claim would be modified to monitoring stage current, this limitation is inherent in Lundquist's sect.[0015], and hence, remain unpatentable.

Note, the previous rejection based on "mixing" the two alternatives has been better and clearly expressed as "choosing either one of" the two alternatives" without changing the ground of rejection. This allows this Office Action to be made Final.

11. Regarding the rejections of claims 1-13, Applicant's argument that "*Lundquist in view of general knowledge in the art does not show all the limitations of claims 1-13*", is unpersuasive, because Lundquist et al. indeed teach the use of secondary emission and stage current monitoring, as recited many times previously. Furthermore, Applicant's recitation of the wording "*all the limitations of claims 1-13*" is not specific enough in pointing out Applicant's argument and to allow the Examiner to respond, and is therefore considered unpersuasive.

Final Rejection

12. No new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP §706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of

this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Communications

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 571 272 2482. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 571 272 2477. The central fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications as well as for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes

January 12, 2005